

Malheur Reservoir Dam

(aka Willow Creek Dam #3)

Emergency Action Plan (EAP)

National Inventory of Dams (NID) No. OR00390

Malheur County, Oregon

Orchards Water Company

Prepared by

McMillen, LLC

Emergency Action Plan (EAP)

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(aka Willow Creek Dam #3)

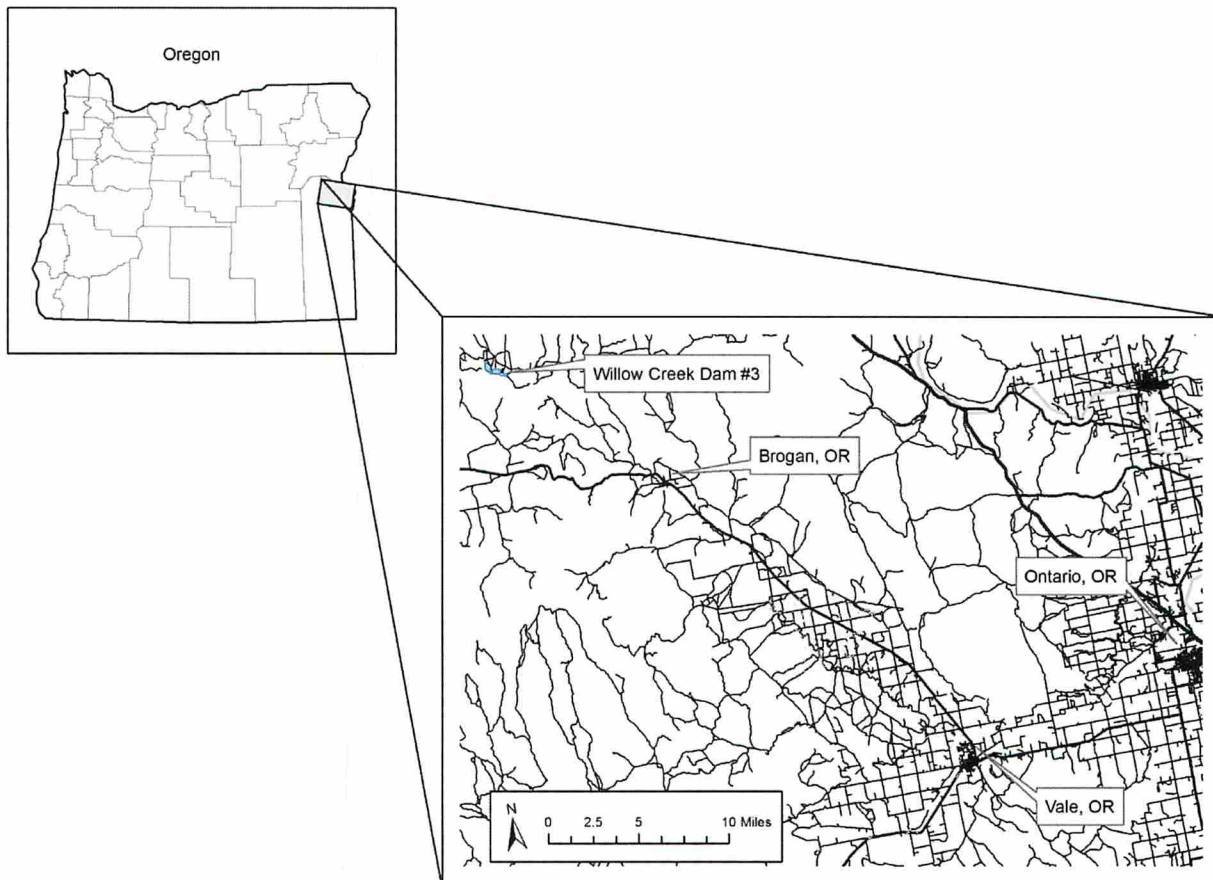
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Urgent – dam failure and flooding is imminent or in progress

Emergency Level 3 Initial Notification

Call 9-1-1 (Read paragraph to Dispatcher) also call Lt. Ron Hunsucker (see page 16)

Message: "I am reporting an emergency at Malheur Dam. This is [name and position] with Orchards Water Company. This is a Level 3 emergency, the dam is failing and a dam breach flood will occur. People are in danger and need to evacuate. Please implement the emergency action plan. I am at [location] and can be reached at [phone number] after I have made emergency notifications."

Refer to Page 16 in the EAP for additional contacts to call

Potential dam failure situation is rapidly developing

Emergency Level 2 Notifications

1. Call list of contacts (information on page 15)
2. Dam owner or representative

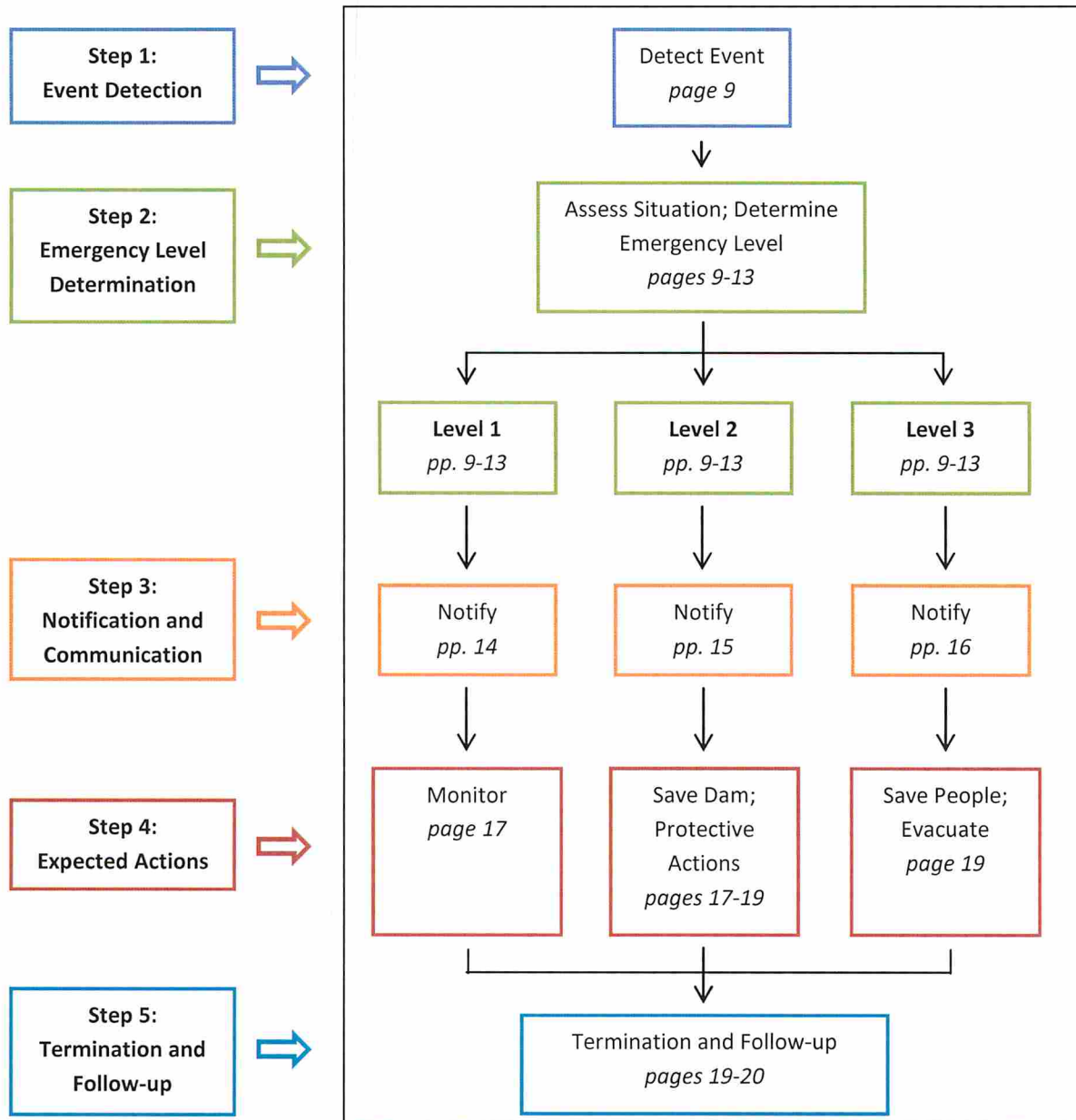
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Refer to Page 15 in the EAP for additional detail

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1.0 EAP Overview



2.0 Basic EAP Data

1.1 Purpose and Intent

The purpose of this Emergency Action Plan (EAP) is to reduce the risk of human loss of life and injury, and to minimize property damage, during an unusual or emergency event at Malheur Dam (aka Willow Creek #3 Dam), by providing a complete and efficient action protocol, should such an event occur.

2.1 Dam Description

Malheur Dam is an earthen embankment dam completed in 1944 by the Orchard Irrigation District. It is situated approximately sixteen miles upstream from the town of Brogan, Oregon in Malheur County. Discharges from the dam flow southeast through a canyon before opening up into a broad agricultural floodplain above Brogan, continuing approximately 40 miles southeast to Vale, OR. At Vale, Willow Creek joins the Malheur River, which flows northeast to Ontario, OR before reaching the Snake River. Malheur dam is classified as a high-hazard dam due to the potential for loss of life in the event of its failure.

The following table lists important information about Malheur dam. More detailed information taken from the National Inventory of Dams can be found in Appendix C.

Height: 110 feet	Drainage Area: 275 mi ²
Built: 1944	Hazard Classification: High
Legal Description: Section 15, T14S, R41E	Dam Operator: Orchards Water Company
Latitude: 44.353° Longitude: -117.6715°	Major Property Owner: Orchards Water Company
National Inventory of Dams Number: OR00390	

2.2 Directions to the Dam

Malheur dam is accessed from the south by heading northbound from Vale, OR on the John Day Highway (US-26) approximately 24 miles through the towns of Jamieson and Brogan. After Brogan, continue on US-26 west approximately 1.8 miles and turn right onto Willow Creek Road. Continue on Willow Creek Road for approximately 11.8 miles and turn left onto an unnamed dirt road. This dirt road is gated, with keys available from District 9 Watermaster. The dam and reservoir are approximately 0.5 miles down the road.

2.3 Potential Impacted Area

Inundation maps of the area are included in Appendix A, and extend from Willow Creek Dam #3 down to Ontario, which represents the area affected by a dam failure. The extent and duration of flooding will depend on the conditions prior to the dam break. For the high-flow event simulated (PMF), the maps included in Appendix A assume that Willow Creek Reservoir is filled to the lowest point of the dam crest,

while for the low-flow event (Sunny Day), the maps assume a pool at maximum normal pool elevation. Furthermore, the input hydrograph representing the high-flow event is significantly larger than that input for the low-flow event. Consequently, the resulting inundations for the respective events are quite different. In reality, the extents and duration of flooding will lie somewhere between these two extremes.

Both PMF and Sunny Day breaches of Willow Creek Dam #3 indicate severe inundation over the entire length of the reach, from Brogan all the way to Ontario (see page 27). The horizontal extents of flooding are only slightly higher during the PMF event over the Sunny Day event; however, the maximum depths are appreciably higher. At Vale, OR a significant portion of the town is flooded during the Sunny Day event, while most, if not all, of the town would be flooded during a PMF breach (see page 28). At Ontario, the impact is less severe, as the Malheur River helps to attenuate the flood. However, flooding is again observed, particularly in low-lying areas in the north of Ontario (see page 29).

3.0 Roles and Responsibilities

Dam Owner

- Respond to observed or reported conditions, incidents, or unusual events to detect if an existing or potential emergency exists (see Step 1—Event Detection, page 8).
- Take all reasonable actions to save dam during Emergency Level 1 or 2.
- As soon as an emergency event is detected, immediately determine the emergency level (see Step 2—Emergency Level Determination, page 8).
 - Level 1: Non-emergency incident; Unusual event; Slowly developing situation
 - Level 2: Potential dam failure situation; Rapidly developing
 - Level 3: Urgent; Dam failure is imminent or in progress
- Immediately notify the personnel in the order shown on the notification flow chart for the appropriate emergency level (see notification flow charts on pages 15-17).
- Provide updates of the situation to the Local Emergency Manager to assist them in making timely and accurate decisions regarding warnings and evacuations.

Local Emergency Manager

- Typically City Police or Fire Department or County Sheriff Department personnel act as the Local Emergency Manager.
- Serve as the primary contact person responsible for coordination of all emergency actions.
- Maintain communication with media.
- When a Level 2 situation occurs:
 - Prepare emergency management personnel for possible evacuations that may be needed if a Level 3 situation occurs.
 - Alert public as appropriate.
- When a Level 3 situation occurs:
 - Initiate warnings and order evacuation of people at risk downstream of the dam.
 - Carry out the evacuation of people and close roads within the evacuation area (see Appendix A: Inundation Maps).
 - Alert the general public of the emergency.
- Decide when to terminate the emergency.
- Participate in annual review and update of the EAP.

Oregon Office of Emergency Management

- Maintain a cooperative liaison with the Local Emergency Manager to help minimize the impacts of an emergency event.

Dam Owner's Engineer

- Provide assistance and expertise with technical issues related to the dam, especially assistance in determination of Level 2 or Level 1 emergency, and dam saving actions.

Oregon State Dam Safety Engineer

- Advise dam owner on emergency level determination if time permits.
- Advise dam owner on remedial actions to take if a Level 2 event occurs and if time permits.
- Advise the Local Emergency Manager when conditions are safe to terminate the emergency.

4.0 The Five-Step EAP Process

Step 1 Event Detection

This step describes the detection of an unusual or emergency event. Information is provided herein to assist the dam owner in determining the appropriate emergency level for the event.

Unusual or emergency events may be detected by:

- Observations by District personnel or Watermaster during day to day operations.
- Observations at or near the dam by government personnel (local, state, or federal), landowners, visitors to the dam, or the public. All reports of an unusual or emergency event should be verified by the dam owner.
- Earthquakes causing damage to buildings in Vale or Brogan
- Forewarning of conditions which may cause an unusual event or emergency event at the dam (for example, a severe weather or flash flood forecast)

See the *Guidance for Determining the Emergency Level* table and *Examples of Emergency Situations* in Step 2 (pages 10-12) for assistance in evaluating specific events to determine if they are unusual or potential emergency situations.

Step 2 Emergency Level Determination

After an unusual or emergency event is detected and verified, the Dam Owner is responsible for classifying the event into one of the following three emergency levels:

Emergency level 1— Non-emergency incident; unusual event; slowly developing situation:

This situation is not normal but has not yet threatened the operation or structural integrity of the dam, but possibly could if it continues to develop. The State Dam Safety Engineer and the Dam Owner's Engineer should be contacted to investigate the situation and recommend actions to be taken. The condition of the dam should be closely monitored, especially during storm events, to detect any development of a potential or imminent dam failure situation. The Local Emergency Manager should be informed if it is determined that the conditions may possibly develop into a worse condition that may require emergency actions.

Emergency level 2—Potential dam failure situation, rapidly developing:

This situation may eventually lead to dam failure and flash flooding downstream, but there is not an immediate threat of dam failure. The Local Emergency Manager should be notified of this emergency situation and placed on alert. The dam owner should closely monitor the condition of the dam and periodically report the status of the situation to the Local Emergency Manager and State Dam Safety

Engineer. As time permits, remedial actions should be taken to delay, moderate, or prevent failure of the dam. If the dam condition worsens and failure becomes imminent, the Local Emergency Manager must be notified immediately of the change in the emergency level to evacuate the people at risk downstream.

The State Dam Safety Engineer should be contacted to evaluate the situation and recommend remedial actions to prevent failure of the dam. The dam owner should initiate remedial repairs (note local resources that may be available – see Appendix A Resources Available). Time available to employ remedial actions may be hours or days.

This emergency level is also applicable when flow through the spillway has, or is expected to, result in flooding of downstream areas where people near the channel could be endangered. Emergency services should be on alert to initiate evacuations or road closures if the flooding increases.

Emergency Level 3—Urgent; dam failure is imminent or in progress:

This is an extremely urgent situation when a dam failure is occurring or obviously is about to occur and cannot be prevented. Flash flooding will occur downstream of the dam. This situation is also applicable when flow through the spillway is causing downstream flooding of people and roads. The Local Emergency Manager should be contacted immediately so emergency services can begin evacuations of all at-risk people and close roads as needed (see Section 9 - Inundation Map).

See following pages for guidance in determining the proper emergency level for various situations.

Specific Emergency Situations for Malheur Reservoir Dam

Malheur Reservoir dam represents a large dam built in two phases. The first section of the dam is considered sound but the dam raise material (top 25 feet of dam) for whatever reason is prone to excessive seepage. Therefore, there is a water level restriction set at elevation **3386 feet** via a bronze marker. When the water level is higher than this marker we are in a Level 1 emergency situation for this dam because the water is approaching the point where there is a danger of building on the dam raise fill and failing the dam. If the valves suddenly break and remain closed, this is another situation that needs notification to officials as a Level 1 emergency and repairs should be made ASAP because it is anticipated that the water would never be able to build up to the spillway level 3415.7 feet elevation but would fail from internal erosion before it gets that high.

Another possibility would be embankment movement and cracking in response to an earthquake. If there is a earthquake causing building damage in Vale or Brogan), the dam should be inspected shortly afterward to check for settlement, cracking, movement and change in seepage as well as operation of the valves for the conduit.

Leakage and internal erosion or downstream face instability (MOST LIKELY SCENARIO FOR FAILURE)

Emergency Level 1 – Any new seep below the dam, or sinkhole on the dam

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Cloudy seepage or soil deposits are observed at seepage exit points or from internal drain outlet pipes (if any).
2. New or increased areas of wet or muddy soils are present on the downstream slope, abutment, and/or foundation of the dam, and there is an easily detectable and unusual increase in volume of downstream seepage.
3. Significant new or enlarging sinkhole(s) near the dam.
4. One or more of the following known dam defects are or soon will be inundated by a rise in the reservoir:
 - i) Sinkhole(s) located on the upstream slope, crest, abutment, and/or foundation of the dam;
 - ii) Transverse cracks extending through the dam, abutments, or foundation.

Emergency Level 3—Urgent; dam failure is imminent or in progress:

1. A piping hole appears in the dam, and flows exceed 10 cfs.
2. A landslide develops on the downstream slope, and water from the reservoir flows through the cracks
3. The landslide extends directly into the reservoir.
4. The crest drops to within 5 feet of water level
5. Whirlpools or other evidence exists indicating that the reservoir is draining rapidly through the dam or foundation.
6. Rapidly enlarging sinkhole(s) are forming on the dam or abutments to the extent that failure appears imminent or is in progress.
7. Rapidly increasing flow through crack(s) eroding materials to the extent that failure appears imminent or is in progress.

Flood – High Inflows Situation

Emergency Level 1- Water rises over water level restriction (exceeds 3386 feet as indicated by Bronze Marker)

Emergency Level 2—Potential dam failure situation; rapidly developing: The reservoir level is 2-20 feet above the water level restriction and inflows are high. At this level, continuous observation of the dam is needed. Dam failure will likely be related to leakage or slope instability in the downstream face.

Earthquake

Emergency Level 1 - Any earthquake of 6.0 or greater on Richter Scale centered within 150 miles to dam. The level should not be raised higher unless there is evidence of cracking or a subsequent seepage failure below the dam.

Step 3 Notification and Communication

Notification:

After the emergency level has been determined, people on the following notification flowcharts (pages 14-16) for the appropriate emergency level shall be notified immediately.

Communication: Malheur dam is remote, with limited cell phone coverage. The closest place to the dam for communications is available in Brogan (cell coverage is available on Verizon in high spots such as ridges).

Emergency Level 1— Non-emergency incident; unusual event; slowly developing situation:

The Dam Owner should contact State Dam Safety Engineer and the Dam Owner's Engineer (see page 14), describe the situation, and request technical assistance on the next steps that should be taken.

Emergency Level 2—Potential dam failure situation; rapidly developing:

The Dam Owner should contact Local Emergency Manager, State Dam Safety Engineer, and the Dam Owner's Engineer (see page 15), describe the situation, and request technical assistance on the next steps that should be taken. The following message may be used to help describe the emergency situation to the Local Emergency Manager:

Message: "I am reporting an emergency at Malheur Dam. This is [name and position] with Orchards Water Company. At this time it is a Level 2 emergency. Please inform Lieutenant Rob Hunsucker and make other emergency contacts as necessary to prepare for possible evacuations. I am at [location] and can be reached at [phone number]. We are taking emergency actions to save the dam, and will contact the State dam safety engineer and our engineer for technical advice on preventing a Level 3 Emergency.

The Local Emergency Manager should contact local residents and others in the area that may be potentially affected by a failure. These people are to use this information at their discretion.

Emergency Level 3—Urgent; dam failure is imminent or in progress:

The Local Emergency Manager must be contacted immediately (see page 16) and the potentially flooded area must be evacuated (see *Appendix A: Inundation Maps*). The following actions should be taken:

- 1) Call 911 and be sure to say, "**This is an emergency**". The following message may be used to help describe the emergency situation to the Local Emergency Manager:

Message: "I am reporting an emergency at Malheur Dam. This is [name and position] with Orchards Water Company. This is a Level 3 emergency, the dam is failing and a dam breach flood will occur. People are in danger and need to evacuate. Please inform Lieutenant Rob Hunsucker and make other emergency contacts as necessary to start evacuation immediately. Please implement the emergency action plan. I am at [location] and can be reached at [phone number] after I have made emergency notifications."

- 2) Keep in frequent contact with the Local Emergency Manager to keep them up-to-date on the condition of the dam. They will tell you how you can help handle the emergency.
- 3) If all means of communication are lost: (1) try to find out why, (2) try to get to another radio or telephone that works, or (3) get someone else to try to reestablish communications. If these means fail, handle the immediate problems as well as you can, and periodically try to reestablish contact with the Local Emergency Manager and emergency services.

The following pre-scripted message may be used as a guide for the Local Emergency Manager to communicate the status of the emergency with the public:

Attention: This is an emergency message from (the Local Emergency Manager). Listen carefully. Your life may depend on immediate action.

Willow Creek Dam #3 is failing. Repeat. Willow Creek Dam #3 is failing. If you are in or near this area, proceed immediately to high ground away from the valley. Do not travel on (names of roads or highways) or return to your home to recover your possessions. You cannot outrun or drive away from the flood wave. Proceed immediately to high ground away from the valley.

Repeat message

Emergency Level 1 Notifications																																						
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Step 4 Expected Actions

If a Local Emergency Manager receives a 911 call regarding observations of an unusual or emergency event at the dam, they should immediately contact the Dam Owner. After the Dam Owner determines the emergency level, the State Dam Safety Engineer should be contacted for technical consultation and the following actions should be taken.

Emergency Level 1 – Non-emergency incident; unusual event; slowly developing situation:

- A. The Dam Owner should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also check the reservoir area, abutments, and downstream channel for signs of changing conditions. If increased seepage, erosion, cracking, or settlement is observed, immediately report the observed conditions to the State Dam Safety Engineer; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.
- B. Record all contacts that were made and all information, observations, and actions. Note the time of changing conditions. Document the situation with photographs and video if possible.
- C. The Dam Owner should contact the State Dam Safety Engineer and Dam Owner's Engineer and request technical staff to investigate the situation and recommend corrective actions.

Emergency Level 2 – Potential dam failure situation; rapidly developing:

- A. The Dam Owner should contact the Local Emergency Manager to inform him/her that the EAP has been activated and, if current conditions get worse, the emergency level may increase and the emergency situation may require evacuation. Preparations should be made for possible road closures and evacuations.
- B. The dam owner should get help from District personnel and their engineer to help communicate and save the dam.
- C. The Dam Owner should report the situation to the State Dam Safety Engineer and the Dam Owner's Engineer and request investigation of the situation and recommend corrective actions.
- D. Provide updates to the Local Emergency Manager to assist them in making timely decisions concerning the need for warnings, road closures, and evacuations.
- E. If time permits, the Dam Owner should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also check the reservoir area, abutments, and downstream channel for signs of changing conditions. If piping, increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the Local Emergency Manager and State Dam Safety Engineer. Refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.
- F. Record all contacts that were made and all information, observations, and actions taken. Note the time of changing conditions. Document the situation with photographs and video, if possible.

- G. If time permits, the following emergency remedial actions should be considered for Emergency Level 2 conditions. Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the dam. Several of the listed adverse or unusual conditions may be apparent at the dam at the same time, requiring implementation of several modes of remedial action. Close monitoring of the dam must be maintained to confirm the success of any remedial action taken at the dam. Time permitting, any remedial action should be developed through consultation with the State Dam Safety Engineer. See Appendix B for sources of equipment and materials to assist with remedial actions.

Water Above Restricted Level

Open outlet(s) to lower the reservoir level as rapidly as possible to a level to 3386 feet.

Seepage and sinkholes

- 1) that stops or decreases the seepage to a nonerosive velocity. If the outlet is damaged, blocked, or of limited capacity, pumping or siphoning may be required. Continue lowering the water level until the seepage stops.
- 2) If the entrance to the seepage origination point is observed in the reservoir (possible whirlpool) and is accessible, attempt to reduce the flow by plugging the entrance with readily available materials, such as hay bales, bentonite, soil or rock fill, or plastic sheeting.
- 3) Cover the seepage exit area(s) with several feet of sand/gravel to hold fine-grained embankment or foundation materials in place. Alternatively, construct sandbag or other types of ring dikes around seepage exit areas to retain a pool of water, providing backpressure and reducing the erosive nature of the seepage.
- 4) Prevent vehicles and equipment from driving between the seepage exit points and the embankment to avoid potential loss from the collapse of an underground void.

Embankment movement

- 1) Open outlet(s) and lower the reservoir until an engineer determines the slide or slump is stable. If the outlet is damaged, blocked, or of limited capacity, pumping or siphoning may be required.
- 2) Repair settlement of the crest by placing sandbags or earth and rock fill materials in the damaged area to restore freeboard.
- 3) Stabilize slides on the downstream slope by placing a soil or rock fill buttress against the toe area of the slide.

Significant Earthquake

- 1) Immediately conduct a general overall visual inspection of the dam.
- 2) Perform field survey to determine if there has been any settlement and movement of the dam embankment, spillway and low level outlet works.
- 3) Open outlet valves if damage threatens dam integrity.

Emergency Level 3—Urgent; dam failure is imminent or in progress:

- A. The Dam Owner shall immediately contact the Local Emergency Manager and others shown on the notification flow chart. Personnel should stay off the dam and at an elevation above the reservoir.
- B. The Malheur County Emergency Manager shall lead the efforts to carry out warnings, close roads, and evacuate people at risk downstream from the dam (see Appendix A).
- C. The Local Emergency Manager shall alert the general public and immediately evacuate at-risk people and close roads as necessary.
- D. The Dam Owner shall maintain continuous communication and provide the Local Emergency Manager with updates of the situation to assist him in making timely decisions concerning warnings and evacuations.
- E. The Dam Owner should record all contacts that were made and all information, observations, and actions taken. Note the time of changing conditions. Document the situation with photographs and video, if possible.
- F. Advise people monitoring the dam to follow safe procedures. Everyone should stay away from any of the failing structures or slopes and out of the potential breach inundation areas.

Step 5 EAP Termination

Whenever the EAP has been activated, an emergency level has been declared, all EAP actions have been completed, and the emergency is over, the EAP operations must eventually be terminated and follow-up procedures completed.

Termination responsibilities

The Local Emergency Manager is responsible for terminating EAP operations and relaying this decision to the Dam Owner. It is then the responsibility of each person to notify the same group of contacts that he or she notified during the original event notification process to inform those people that the event has been terminated.

Prior to termination of an Emergency Level 2 or 3 event, the State Dam Safety Engineer or Dam's consulting Engineer will inspect the dam or require the inspection of the dam to determine if any hazardous conditions exist that could potentially result in loss of life, injury, or property damage. If it is determined that hazardous conditions no longer exist, the Engineer will advise the Local Emergency Manager to terminate EAP operations as described above.

5.0 Maintenance: EAP Review and Revision

Emergency Action Plans should be considered “Living Documents”. This means that: (1) They will never be complete, (2) They should be reviewed not less than annually, (3) Reviews should include participation of the local emergency manager, (4) All updates should be made promptly. Additionally, emergency incidents at dams and/or dam failures are not common events. Therefore, training and exercises are important to maintain emergency response readiness, timeliness, and effectiveness.

The EAP therefore requires periodic maintenance to remain current and as useful and effective as possible. The three steps in Maintenance include:

5.1 Review

The EAP minimum annual review should include the following:

- Calling all contacts on the three notification charts in the EAP to verify that the phone numbers and persons in the specified positions are current.
- Contacting all record holders of the EAP to verify where the EAP is kept and if responsibilities as described in the EAP are understood.
- Calling the locally available resources to verify that the phone numbers, addresses, and services are current.
- Review people and structures at risk information for changes in development within the dam failure flood inundation area downstream of the dam.

5.2 Revision

The EAP will be revised if any of the contacts, responsibilities, services or service providers, or people at risk information has changed. The Dam Owner is responsible for updating the EAP documents. The EAP document held by the Dam Owner is the master document. When revisions occur, the Dam Owner should provide the revised pages and a revised Revision Summary Page to all the EAP document holders. The document holders are responsible for revising outdated copy of the respective document(s) whenever revisions are received. Outdated pages shall be immediately discarded to avoid any confusion with the revisions.

5.3 EAP Exercise

Periodic training and exercises are necessary to help ensure that all dam owner personnel are thoroughly familiar with the emergency action plan and their individual roles and responsibilities.

EAP exercising can include:

- Orientations
- Phone Drills
- Table Top Exercises
- Functional Exercises

As a minimum, owners of high and significant hazard dams should conduct an orientation and a phone drill on a regular basis. The orientation can be a simple meeting where those individuals and entities with a stake in the EAP come together to review the roles and responsibilities described in the EAP. Orientations are especially useful for bringing new staff and/or leadership within any of the various organizations up to speed with regard to the components of the EAP.

Phone drills represent the next level of complexity with regard to EAP exercises. Phone drills can be part of the EAP review process to confirm contact information in the notification flow charts.

A comprehensive EAP exercise program can include provisions for table top exercise and even functional exercises. Because of the simplicity of this rural dam and downstream jurisdictions, a functional exercise is probably not necessary. Tabletop and Functional exercises are typically more complex and are therefore conducted at lower frequencies, on the order of about every 6 years. Owners of high hazard dams should maintain a comprehensive exercise program which includes the components listed above. The program should be considered a normal part of the O&M program for the structure with the various exercises planned and executed as the owner would perform O&M on the physical components of the dam itself.

Key personnel from State dam safety and local emergency management agencies should be invited to participate in any orientation and exercises provided by the dam owner.

6.0 Record of Holders of Control Copies

Copy Number	Organization	Person receiving Copy
1	Orchards Water Company 922 Haul Road Vale, OR 97918	John Pew
2	Oregon Water Resources Department 725 Summer Street NE, Suite A Salem, OR 97301	Keith Mills
3	Malheur County Courthouse #4 251 B Street W Vale, OR 97918	Ron Jacobs
4	Malheur County Emergency Services 151 B Street W Vale, OR 97918	Lt. Rob Hunsucker
5	McMillen-LLC 1401 Shoreline Dr. Boise ID 83702	E. George Robison

7.0 Record of Revisions and Updates

[illegible]

8.0 Concurrences

1. John Pew Orchards Water Co. 2-15-12
Signature Organization Date

Printed Name and Title: John Pew

2. Keith Mills Oregon Water Resources Dept. January 31, 2012
Signature Organization Date

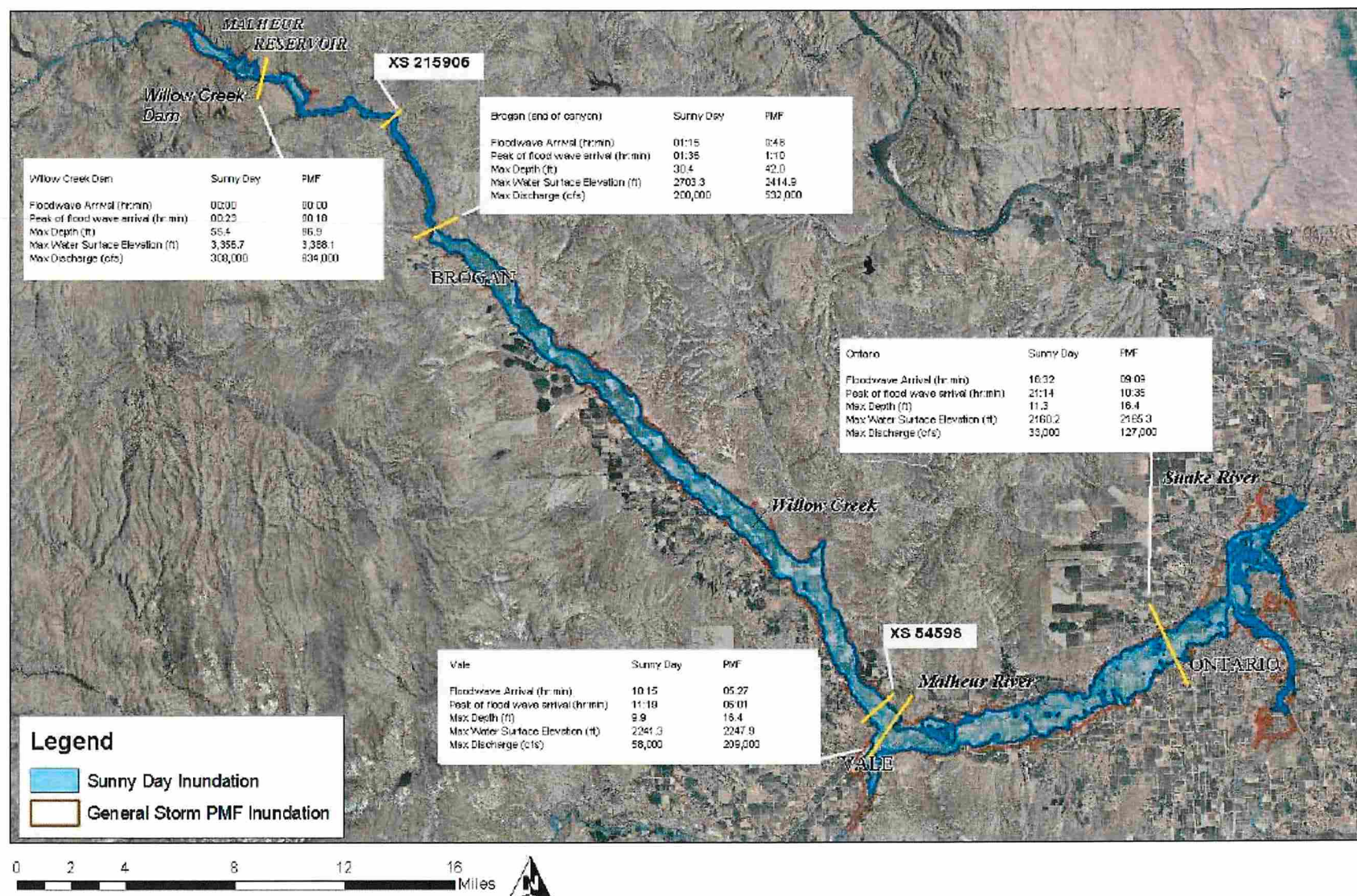
Printed Name and Title: Keith Mills, Oregon State Dam Safety Engineer

3. R Hunsucker Malheur County Emergency Management 2/14/12
Signature Organization Date

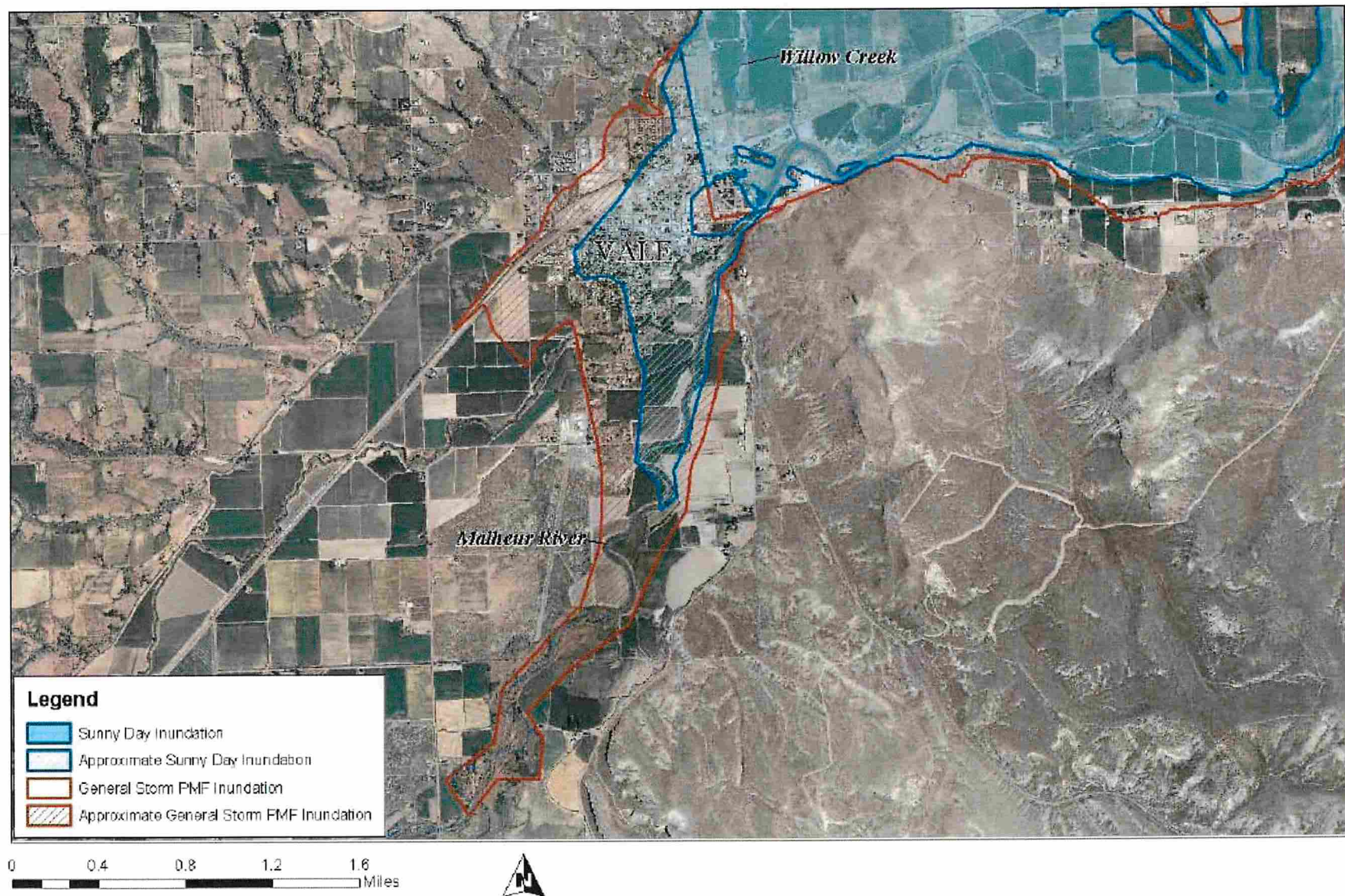
Printed Name and Title: Lt. Rob Hunsucker, Emergency Services Commander

9.0 Inundation Maps

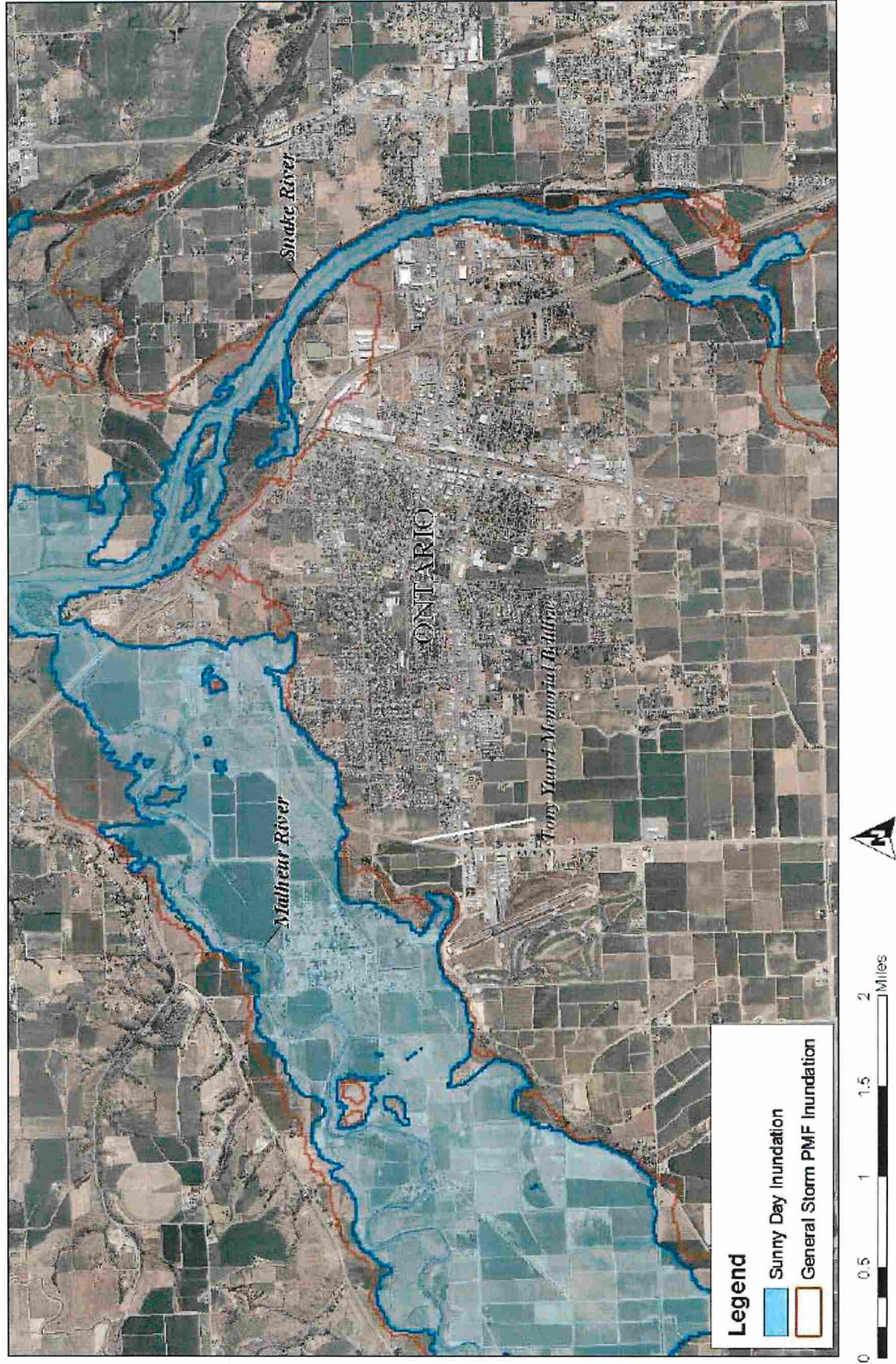
Overview Inundation Map Due to a Breach of Willow Creek Dam #3 During PMF and Sunny Day Events



Inundation Map of Vale, OR Due to a Breach of Willow Creek Dam #3 During PMF and Sunny Day Events



Inundation Map of Ontario, OR Due to a Breach of Willow Creek Dam #3 During PMF and Sunny Day Events



Appendix A: Available Local Resources

Heavy equipment service and rental					
Name:	Romans Parts and Machinery	Name:	Ontario Tool & Rental	Name:	
Address:	787 12th Street Vale, OR 97918-1292 (541) 473-2255	Address:	35 NE 1st St, Ontario, OR 97914 (855) 269-8090	Address:	
Sand and gravel supply					
Name:	Mendiola Jim Gravel Products	Name:	Fox Sand & Gravel	Name:	Best Concrete & Gravel
Address:	3997 Kochsmeier Rd Vale, OR 97918 (541) 473-2296.	Address:	460 Stanton Blvd, Ontario, OR 97914 (541) 889-9113	Address:	891 Onion Ave Ontario, OR 97914 (541) 889-9298
Ready-mix concrete supply					
Name:	Best Concrete & Gravel	Name:		Name:	
Address:	891 Onion Ave Ontario, OR 97914 (541) 889-9298	Address:		Address:	
Pumps					
Name:	Romans Parts and Machinery	Name:	Ontario Tool & Rental	Name:	
Address:	787 12th Street Vale, OR 97918-1292 (541) 473-2255	Address:	35 NE 1st St, Ontario, OR 97914 (855) 269-8090	Address:	
Diving Contractor					
Name:	Global Diving & Salvage Inc	Name:		Name:	
Address:	3840 W Marginal Way SW Seattle, WA 98106 (206) 623-0621	Address:		Address:	
Sand Bags					
Name:	Ontario Tool & Rental	Name:		Name:	
Address:	35 NE 1st St, Ontario, OR 97914 (855) 269-8090	Address:		Address:	

Appendix B: National Inventory of Dams (NID) Data

Dam Name	Willow Creek Dam #3
River	Willow Creek
State	OR
County	Malheur
NID Height (Ft.)	110
Dam Length (Ft.)	610
Owner_Name	Orchards Water Company
Private_Dam	N
NID Storage	49000
Max Discharge	17000
Max Storage	49000
Drainage_Area	275
Longitude	-117.6715
Latitude	44.353
Dam_Designer	
Core	Incomplete
Foundation	
EAP	Yes (this document)
Inspection_Date	Annual 2008-2011
Spillway_Type	Rock unlined
Spillway_Width	Varies
NIDID	OR00390
Owner Type	Private
Dam Type	Earth
Primary Purpose	Irrigation
All Purposes	Irrigation
Other Dam Name	Malheur No. 3; Malheur Dam
Inspection Frequency	Yearly
Dam Height (Ft.)	110
Structural Height (Ft.)	110
Hydraulic Height (Ft.)	69
Surface Area	480

State Reg Dam	Y
State Reg Agency	WRD
Year Completed	1911 (Raised 1936)
StateID	R-219
Section	T14S/R41E/Sec 15
Year Modified	1936
Outlet Valves	18 and 36 inches
Volume	100
Number Of Locks	0
Length Of Locks	0
Width Of Locks	0
Fed Funding	
Fed Design	
Fed Construction	
Fed Regulatory	
Fed Inspection	
Fed Operation	
Fed Owner	
Fed Other	
Source Agency	OR
Submit Date	07/30/2008
Congressional District	OR02
Political Party	R
Normal Storage	20400
Congressional Rep.	Greg Walden (R)
Other Structure Id	
Url Address	
Number Of Separate Structures	0
Permitting Authority	Y
Inspection Authority	Y
Enforcement Authority	Y
Jurisdictional Dam	Y

Appendix C: Glossary of Terms

Abutment	That part of the valley side against which the dam is constructed. The left and right abutments of dams are defined with the observer looking in the downstream direction from the dam.
Acre-foot	A unit of volumetric measure that would cover one acre to a depth of one foot. One acre-foot is equal to 43,560 cubic feet or 325,850 gallons.
Appurtenant Structures	Ancillary features of a dam such as outlets, spillways, powerplants, tunnels, etc.
Boil	A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.
Breach	An opening through a dam that allows the uncontrolled draining of a reservoir. A controlled breach is a constructed opening. An uncontrolled breach is an unintentional opening caused by discharge from the reservoir. A breach is generally associated with the partial or total failure of the dam.
Conduit	A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.
Control section	A usually level segment in the profile of an open channel spillway above which water in the reservoir discharges through the spillway.
Dam	A man-made barrier, together with appurtenant structures, constructed above the natural surface of the ground for the purpose of impounding water.
Dam failure	The uncontrolled release of a dam's impounded water.
Dam Owner	Any person, private or non-profit company, special district, federal, state, or local government agency, or any other entity in direct routine control of a dam and reservoir, and/or directly involved in the physical operation and maintenance of a dam, or proposes to construct a dam.
Drain, blanket	A layer of pervious material placed to facilitate drainage of the foundation and/or embankment.
Drain, chimney	A vertical or inclined layer of pervious material in an embankment to facilitate and control drainage of the embankment fill.
Drain, toe	A system of pipe and/or pervious material along the downstream toe of a dam used to collect seepage from the foundation and embankment and convey it to a free outlet.
Drainage area (watershed)	The area that drains to a particular point on a river or stream.
Drawdown	The difference between a water level and a lower water level in a reservoir within a particular time.

Emergency	A condition that develops unexpectedly, endangers the structural integrity of the dam and/or downstream human life and property, and requires immediate action.
Emergency Action Plan (EAP)	A written document prepared by the dam owner, describing a detailed plan of actions for response to emergency or unusual events, including alerting and warning emergency officials in the event of a potential or imminent dam failure or other emergency related to the safety of the dam and public.
Engineer	A Professional Engineer registered and licensed by the State of Oregon. The Engineer must be sufficiently qualified and experienced in the design, construction, and safety evaluation of the type of dam under consideration.
Filter	One or more layers of granular material graded (either naturally or by selection) so as to allow seepage through or within the layers while preventing the migration of material from adjacent zones.
Freeboard	The vertical dimension between the crest (or invert) of the emergency spillway and the crest of the dam.
Groin	That area along the intersection of the face of a dam and the abutment.
Hazard Classification	The placement of a dam into one of four categories (High, Significant, Low, No Public Hazard) based on the hazard potential derived from an evaluation of the probable incremental adverse consequences due to failure or improper operation of the dam.
Head Cutting	Erosion that extends in an upstream direction.
Height, Jurisdictional	The vertical dimension measured from the elevation of the lowest point of the natural surface of the ground, or from the invert of the outlet pipe if excavated below the natural surface of the ground, whichever is lower, where the low point occurs along the longitudinal centerline of the dam, up to the spillway crest of the emergency spillway.
Instrumentation	An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.
Inundation Map	A map depicting the area downstream from a dam that would reasonably be expected to be flooded in the event of a failure of the dam.
Local Emergency Manager	Person(s) responsible for developing, organizing and exercising a community's emergency operations plan. Typically City Police or Fire Department or County Sheriff's Department personnel act as the Local Emergency Manager.
Notification	To immediately inform appropriate individuals, organizations, or agencies about a potentially emergency situation so they can initiate appropriate actions.
Outlet	A conduit (usually regulated by gates or valves) used for controlled or regulated releases of impounded water from the reservoir.
Piping	The progressive destruction of an embankment or embankment foundation by internal erosion of the soil by seepage flows.
Reservoir	A body of water impounded by a dam.

Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway	An appurtenant structure that conducts overflows from a reservoir.
Spillway, Principal or Service	The overflow structure designed to limit or control the operating level of a reservoir, and first to be activated in runoff conditions.
Spillway, Emergency	The appurtenant structure designed to pass the Inflow Design Flood in conjunction with the routing capacity of the reservoir and any principal or service spillway(s).
Spillway crest	The elevation of the floor of a spillway, grade control structure, or ogee crest above which spillway flow begins.
State Dam Safety Engineer	For purposes of this EAP, Office of the State Engineer division or local field office engineer responsible for safety inspections and determining the safe reservoir storage level of assigned dams.
Toe of dam	The junction of the upstream or downstream face of an embankment with the ground surface.
Top of dam (crest of dam)	The elevation of the uppermost surface of an embankment which can safely impound water behind the dam.